M&S Architecture Support to FCS

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Setting the Conditions

- **Information and communications technology have changed the warfight**
  - Real-time re-planning
  - Massed effects without massed forces
- **Transformation is moving toward further change**
  - Forces lighter, more responsive – yet, more lethal, more survivable

Downside is increased vulnerability to degradation of information ope

What Must Be Done

- **Need exists for common design and development environment for all systems**
  - Integrate new materiel into system of systems during design
  - Test the system in operational context of combined arms
  - Define changes needed in design, as well as in integration scheme for system of systems
- **There exist a set of models and simulations from which we can begin to assemble a common distributed simulation environment at constructive, virtual, and live levels**
  - Examine requirements
  - Develop and integrate virtual prototypes
  - Test and refine O&O
  - Enhance operational testing with system of systems context
  - Develop TTP's; provide embedded training

How to Use the Common Environment: a Walk through a Program in Time

- **Use environment with soldiers in the loop to determine that new requirement can only be met through new development**
- **Test requirements for new item for suitability within the system of systems; examine cost-benefit relationship; AoA**
- **Begin tech demo; provide contractors access to the common distributed environment for their use in analysis and development; concurrently develop government prototype and refine as test data accumulates**
- **Invoke higher fidelity realization of distributed architecture; with man in the loop, evaluate initial O&O**

How it Would be Done, C

- **Construct mock-up with reconfigurable human interface:**
  - Use to begin MANPRINT, refine O&O, begin TTP development – Army makes all results available to contractors
- **Contractors refine designs and make HLA-compliant objects and models of their designs available to the Army: they have used the distributed environment for development, so the HLA interfaces already are operational**
- **Army evaluates two issues:**
  - Does the integrated system of systems support the capabilities of the new item for best integrated effectiveness?
  - If the tech projections for the item materialize, will the item meet its requirements in the context of the overall system?

How it Would be Done, C

- At downselect, Army receives detailed engineering-level virtual prototypes with full-up working HLA interfaces
- Subject virtual prototypes to simulated live-fire testing using, for example, hydrocodes to evaluate interaction with weapon rounds
- "Shoot" prototype guns and "operate" prototype sensors against high-fidelity virtual targets to test lethality, probabilities of acquisition and detection, etc.
- Soldiers "operate" virtual prototypes from a mockup linked into the virtual environment
- Maintenance technicians "repair" prototypes using head-mounted displays, force feedback gloves, and virtual tools
- At IOT&E new equipment will also have interface into virtual environment, along with the virtual prototypes: evaluation can then take place at the level of combined arms units
- At deployment, resulting simulation tools support training for operations and for repair: training can be complete at time of deployment

Where to Start: a SMART Way

- **FCS Program is ideal place to start: implement SMART**
- **Define the initial issues that must be addressed: other issues with less urgency can be foreseen, and unforeseen issues will arise.**
- **One take at those large issues with the most pressing priority:**
  - Will the integrated Objective Force with its O&O have the required operational responsiveness and effectiveness?
  - Will it meet Legacy Force, Joint Force, and Allied Force interoperability requirements? What are the interoperability issues between individual FCS platforms and non-FCS systems such as Comanche?
  - Will the C4ISR architecture the Army (and Joint community) is pursuing support the required FCS survivability and lethality?
  - Conversely, if the FCS projected technology maturity is realized, is that "good enough" to work within the planned system architecture?
  - In the systems architecture with the FCS integrated, are the information operations requirements on soldiers appropriate?

How to Start

- **Identify the required architecture of models and simulations**
  - *Lay out the complete set of all the models and simulations used in a program, for all purposes from requirements definition through virtual prototyping, force-on-force modeling, training, etc.*
  - *Includes the definition of the relationships between models and simulations, such as direct interface (federation), data feeding from one model to another, or no direct interface.*
  - *Includes the data requirements and inputs needed to drive the models, their level of fidelity, and the status of (and potential plans for) VV&A*

- **Recommended way to start**
  - Propose a "nested" arrangement, in which the distributed set of models being used by the RDEC Federation, the Battle labs, and others for the Future Command and Control Experiment, with its flexible representation of C4ISR, is linked within a joint warfighting construct provided by JPSD. The models and sims used would vary from constructive through virtual through live, and the exact set used would vary from one experiment to another. Eventually FCS engineering-level models built by the contractors would be delivered with working HLA interfaces, and would take a place in the architecture.

Simulate and Experiment as We Fight

Joint Environment

NWARS

NTM

JSAF

JSTARS

Eagle OTB Multi-Sim

Global Hawk

Army Environment

DISIM OICW OTB

Eagle OTB Multi-Sim

AC S

M1A1

Eagle OTB C² Grid PTN

M577

C² Grid

FCS Environment

Joint Strike Fighter

JSAF

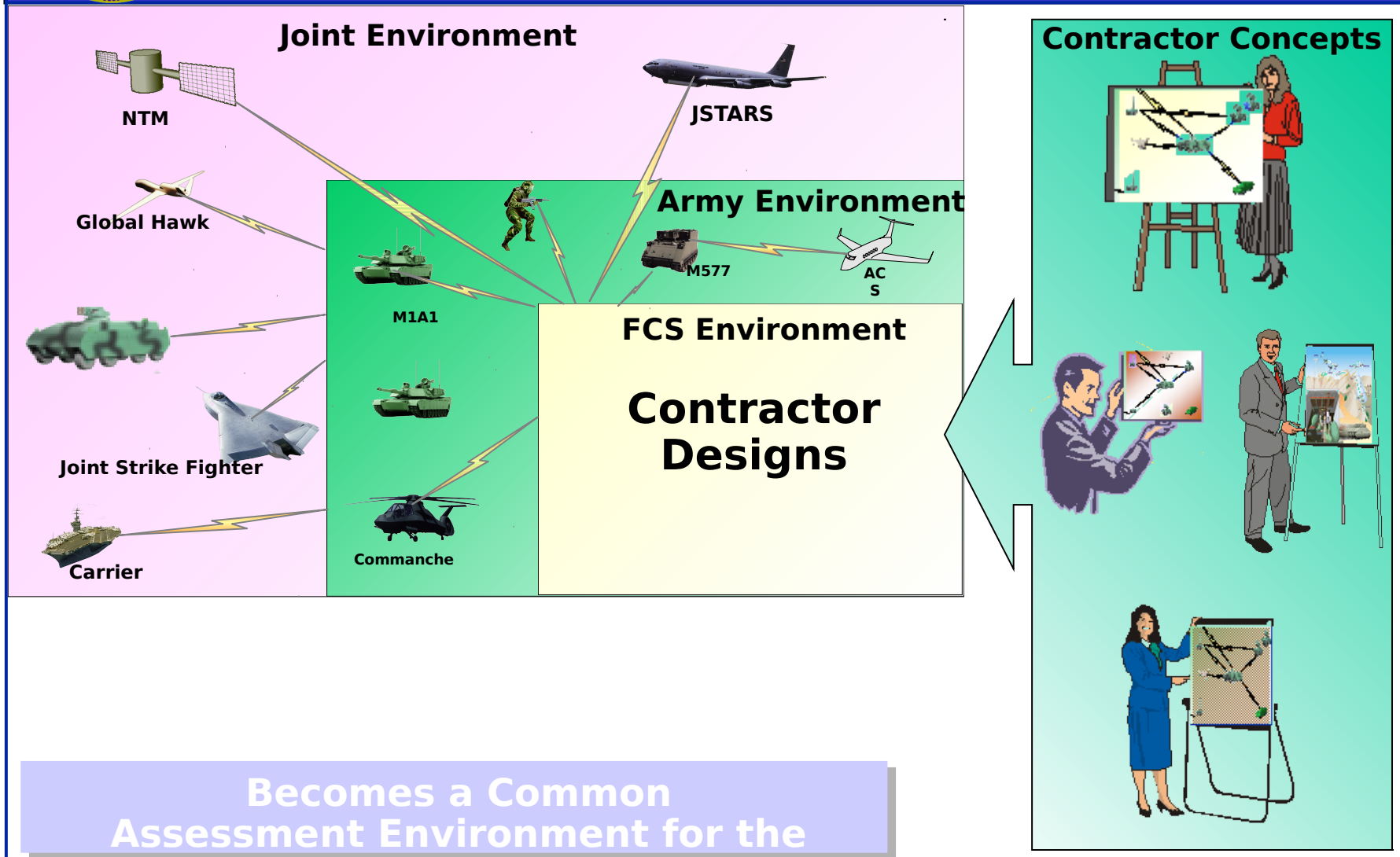
JSAF

Carrier

Comanche

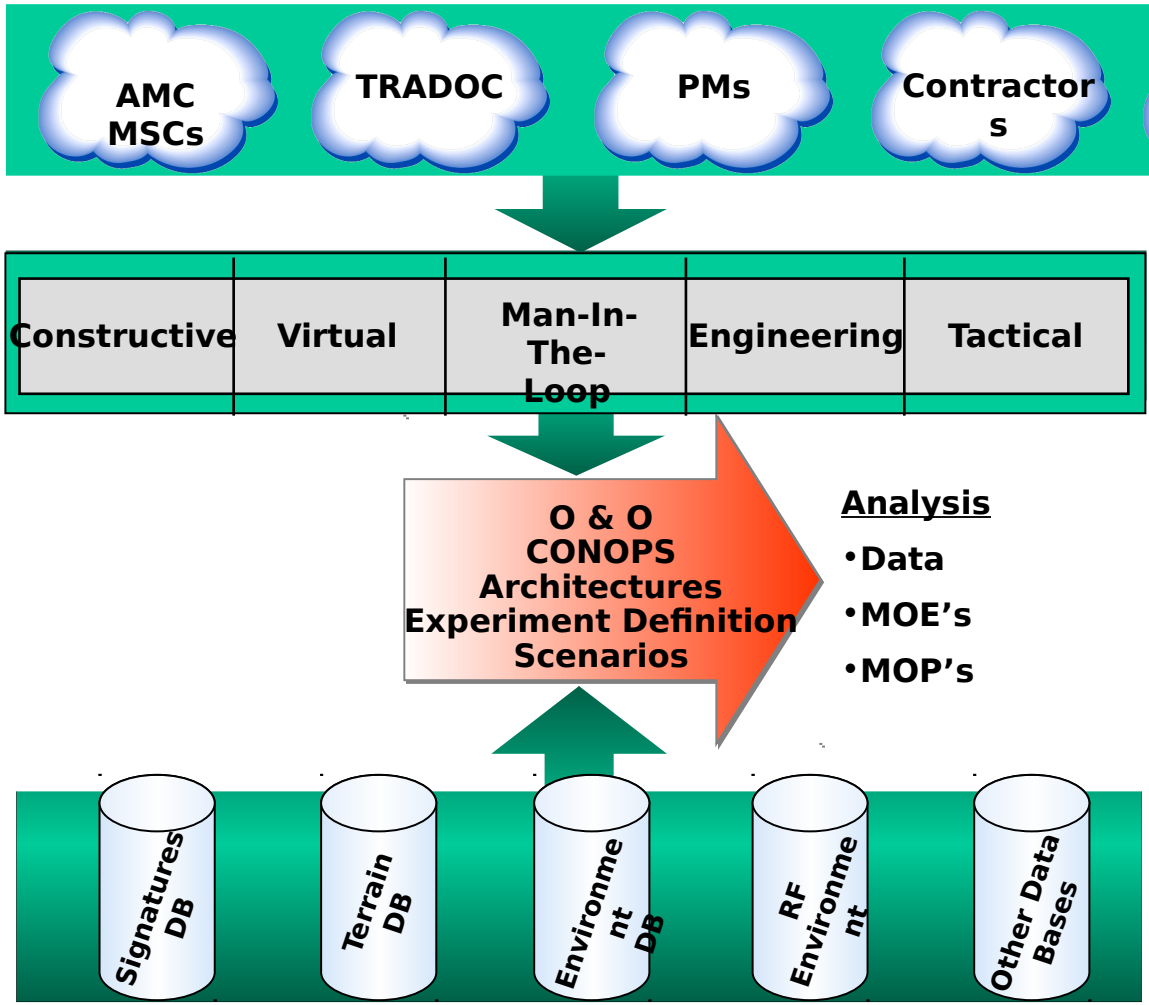
FCS Contractor Models

Common Development Environment for Contractors



Becomes a Common Assessment Environment for the

Flexible "SMART" Environment for FCS Assessment



Characteristics

- Reconfigurable
- Scaleable
- Extensible
- Seamless Interactions
- Common Natural Environment Representations
- Adjustable Fidelity
- Distributed

JVB/RDEC Federation Provides Collaborative Distributed Systems Environment